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Huang et al.

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(54) **CABLE CONNECTOR**

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H01R 4/2454 (2018.01)

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CPC **H01R 4/2433** (2013.01); **H01R 4/2454** (2013.01)

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CPC H01R 4/2445; H01R 4/2433; H01R 4/245; H01R 4/2452; H01R 4/2454; H01R 4/2456
USPC 439/399, 400, 401
See application file for complete search history.

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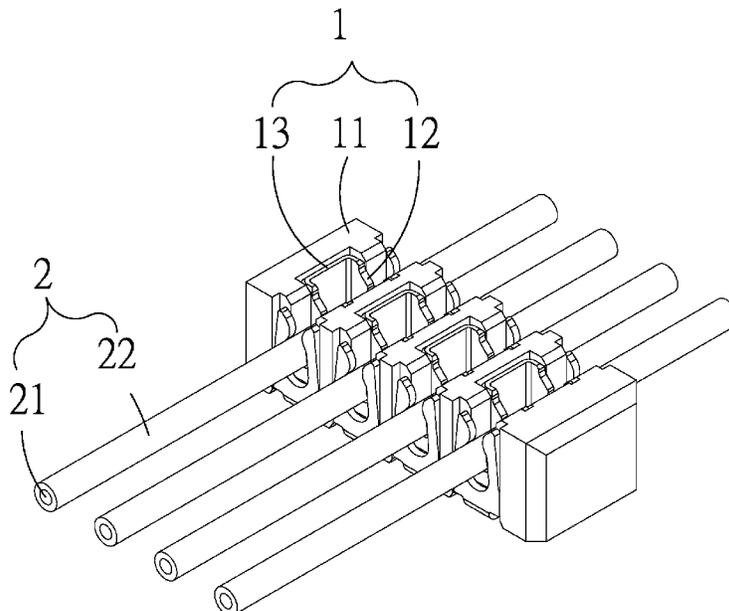
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(57) **ABSTRACT**

A cable connector includes a conductive terminal having a positioning wall and a piercing wall. The piercing wall can pierce an outer insulating sheath of a thin cable to be electrically connected to an inner core of the cable. The positioning wall can position the thin cable to reduce bending or dislocation of the thin cable caused by a force and thus minimize pulling of the core. This ensures electrical connection between the piercing wall and the core of the thin cable, and also prevents the core from being damaged or broken by any pulling force.

14 Claims, 22 Drawing Sheets



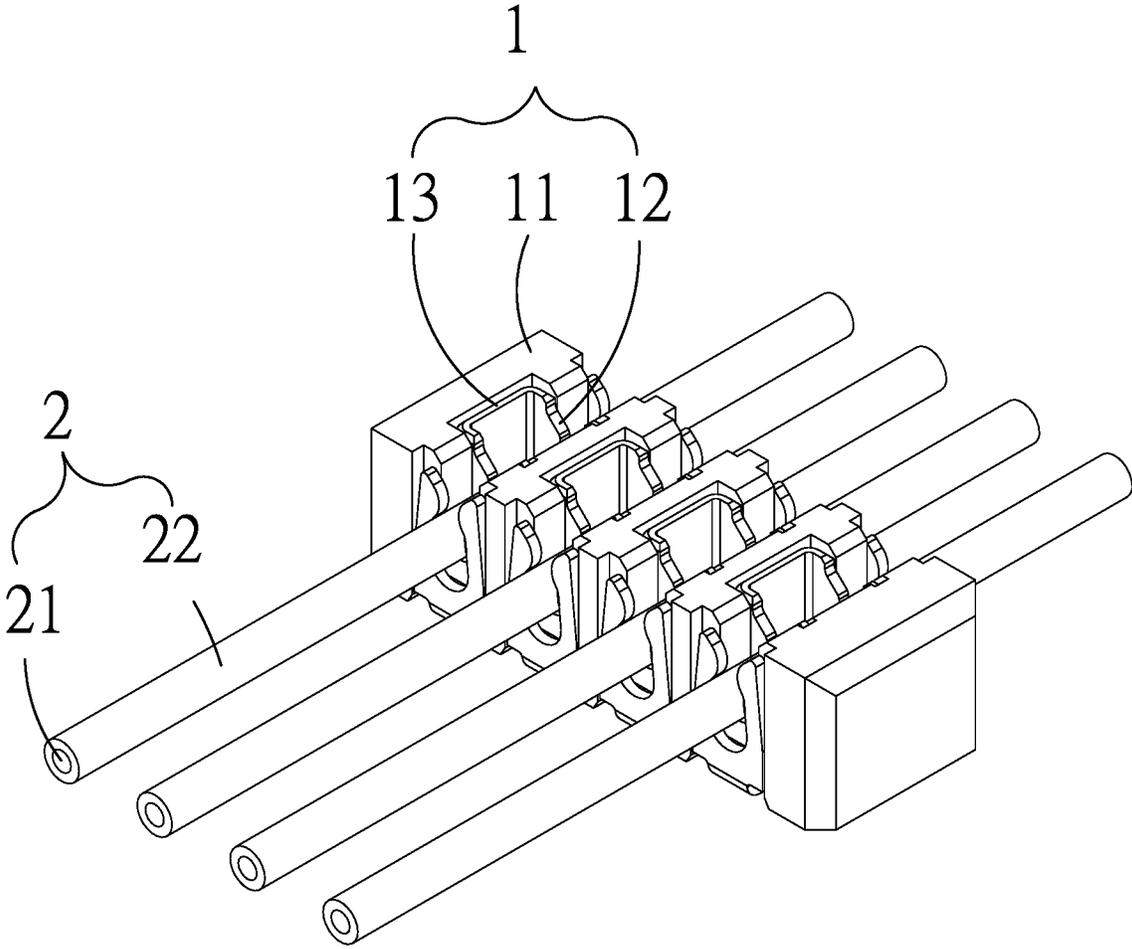


Figure 1

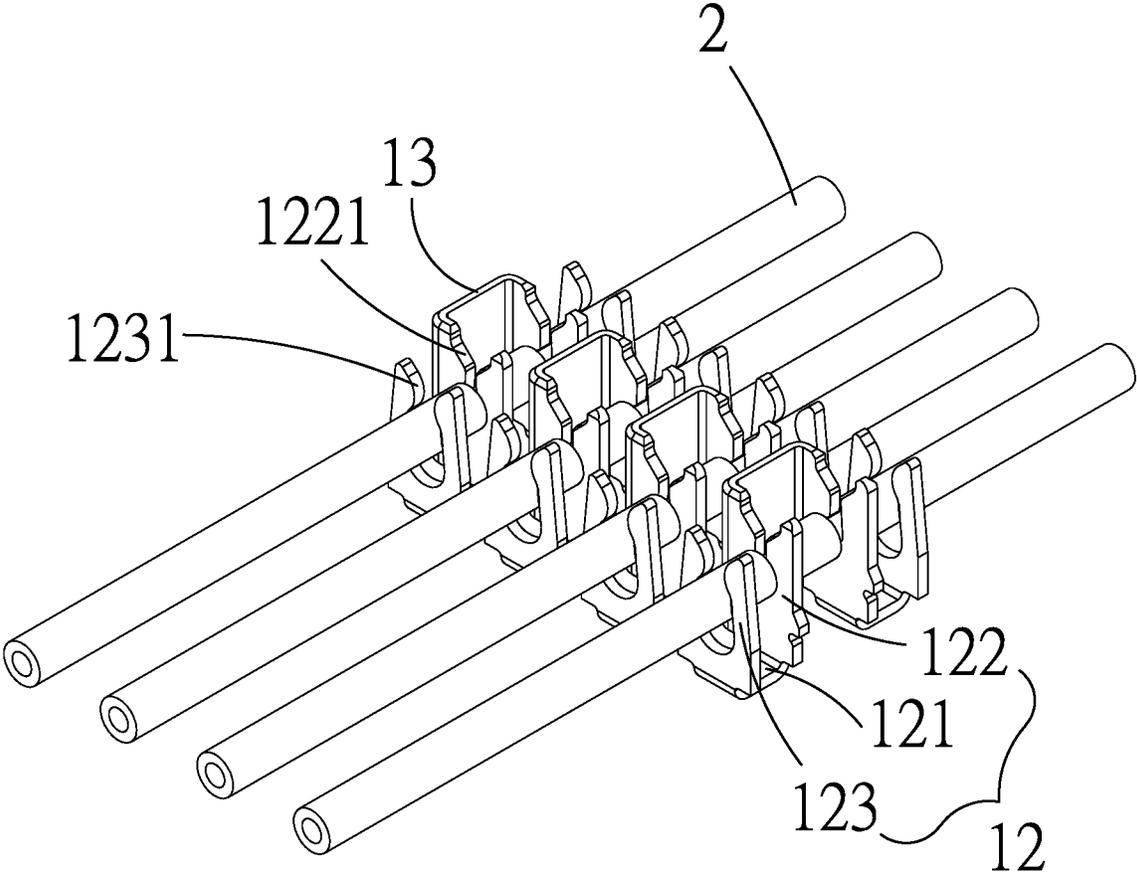


Figure 2

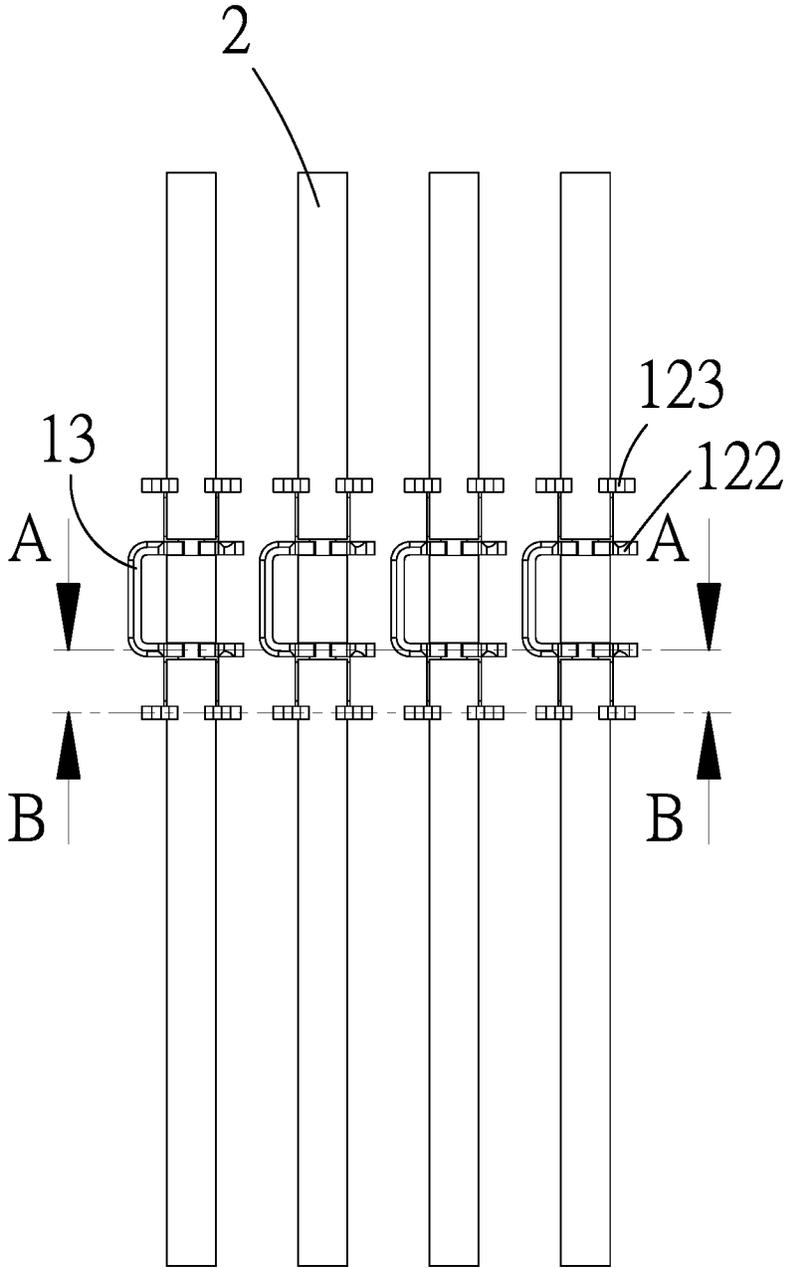


Figure 3

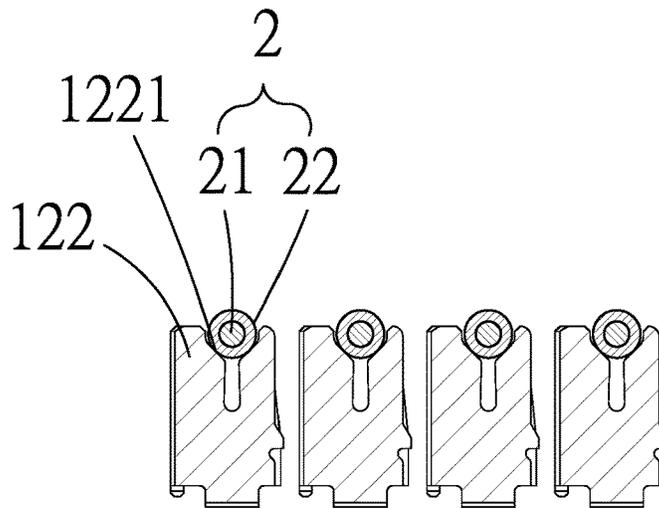


Figure 4-1

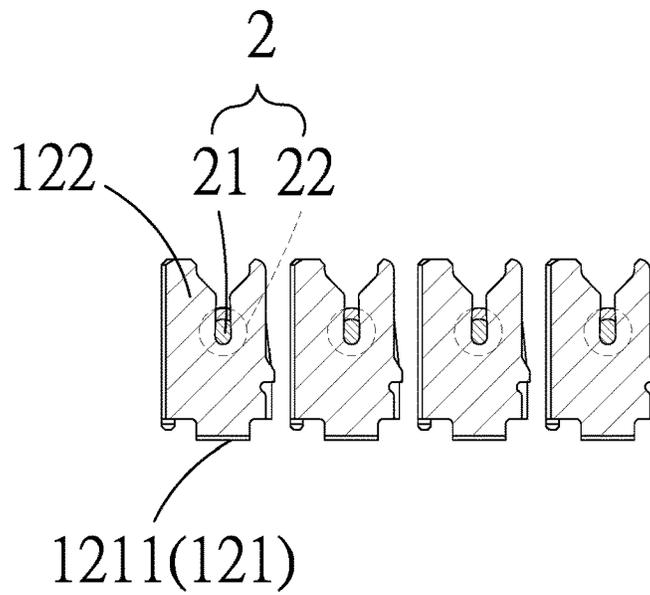


Figure 4-2

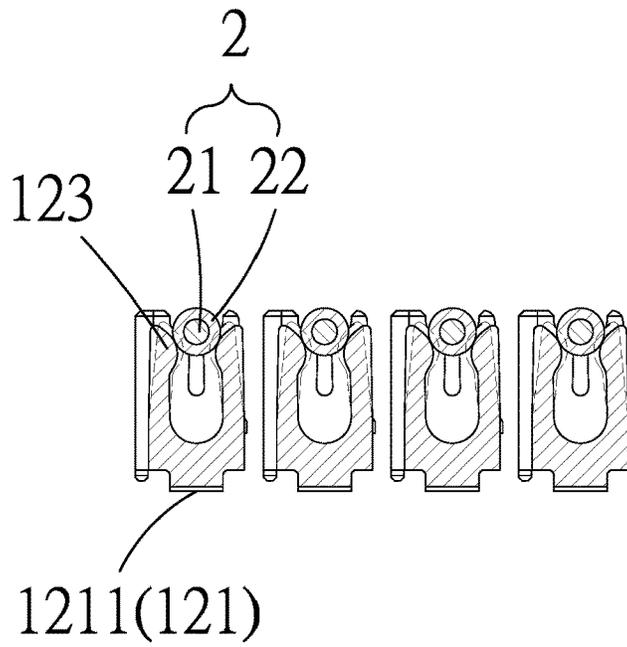


Figure 5-1

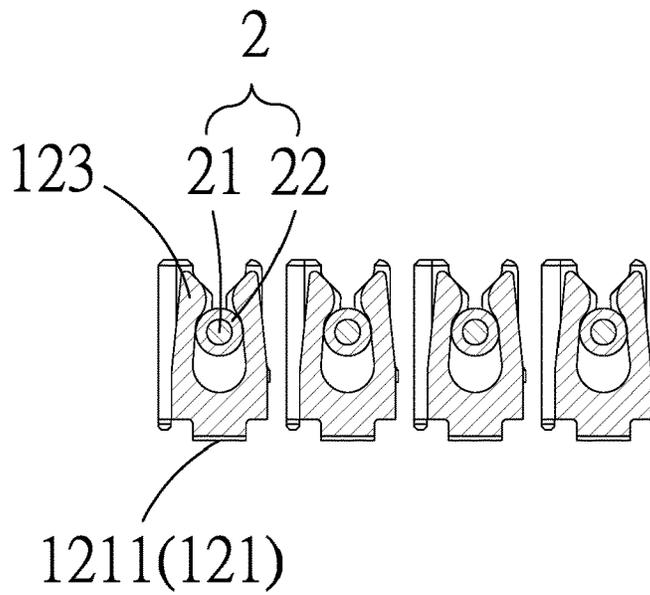


Figure 5-2

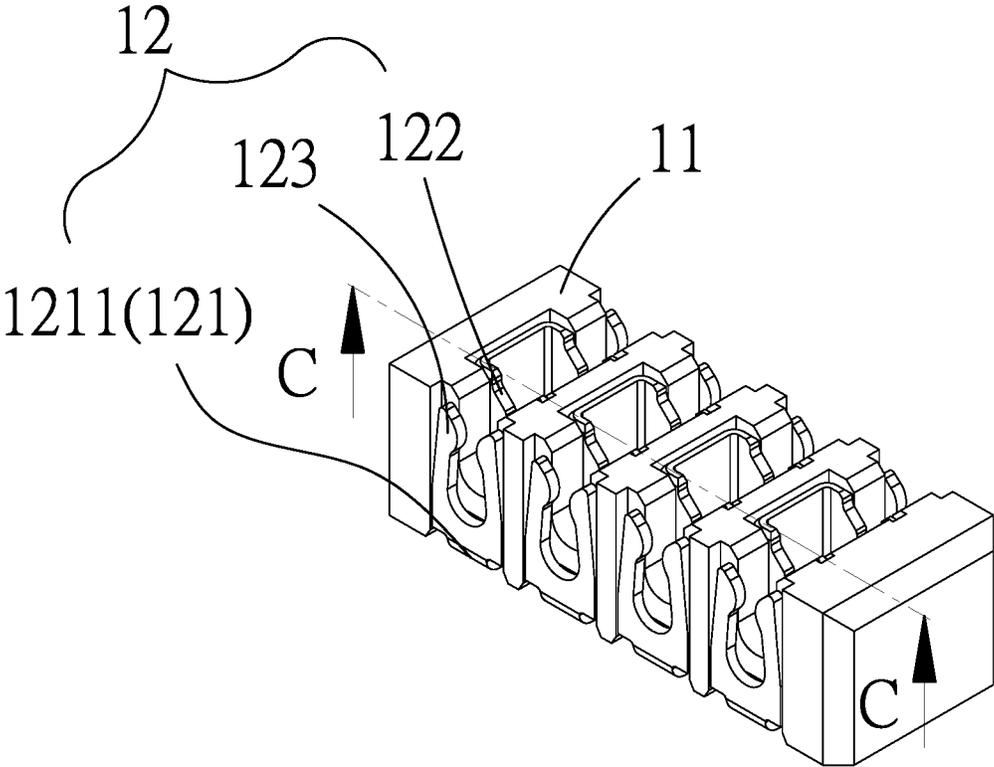


Figure 6

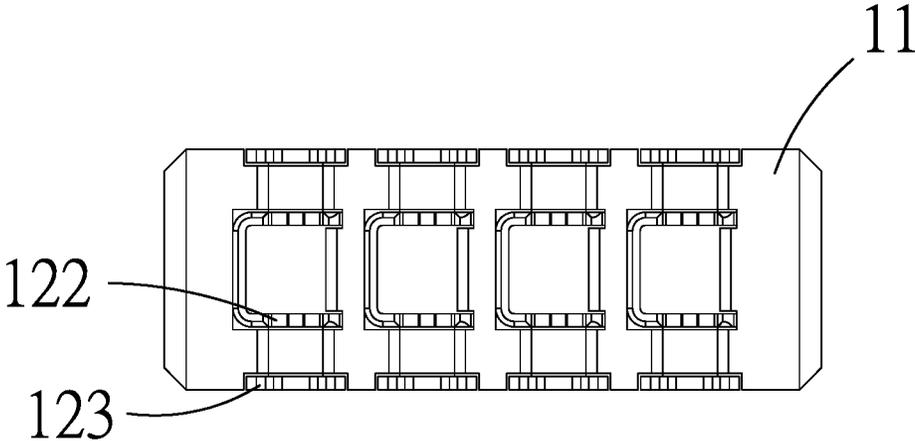


Figure 7

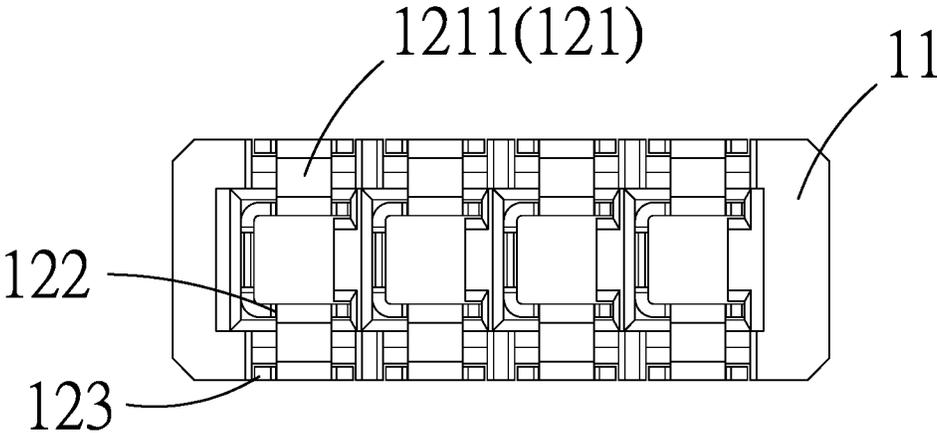


Figure 8

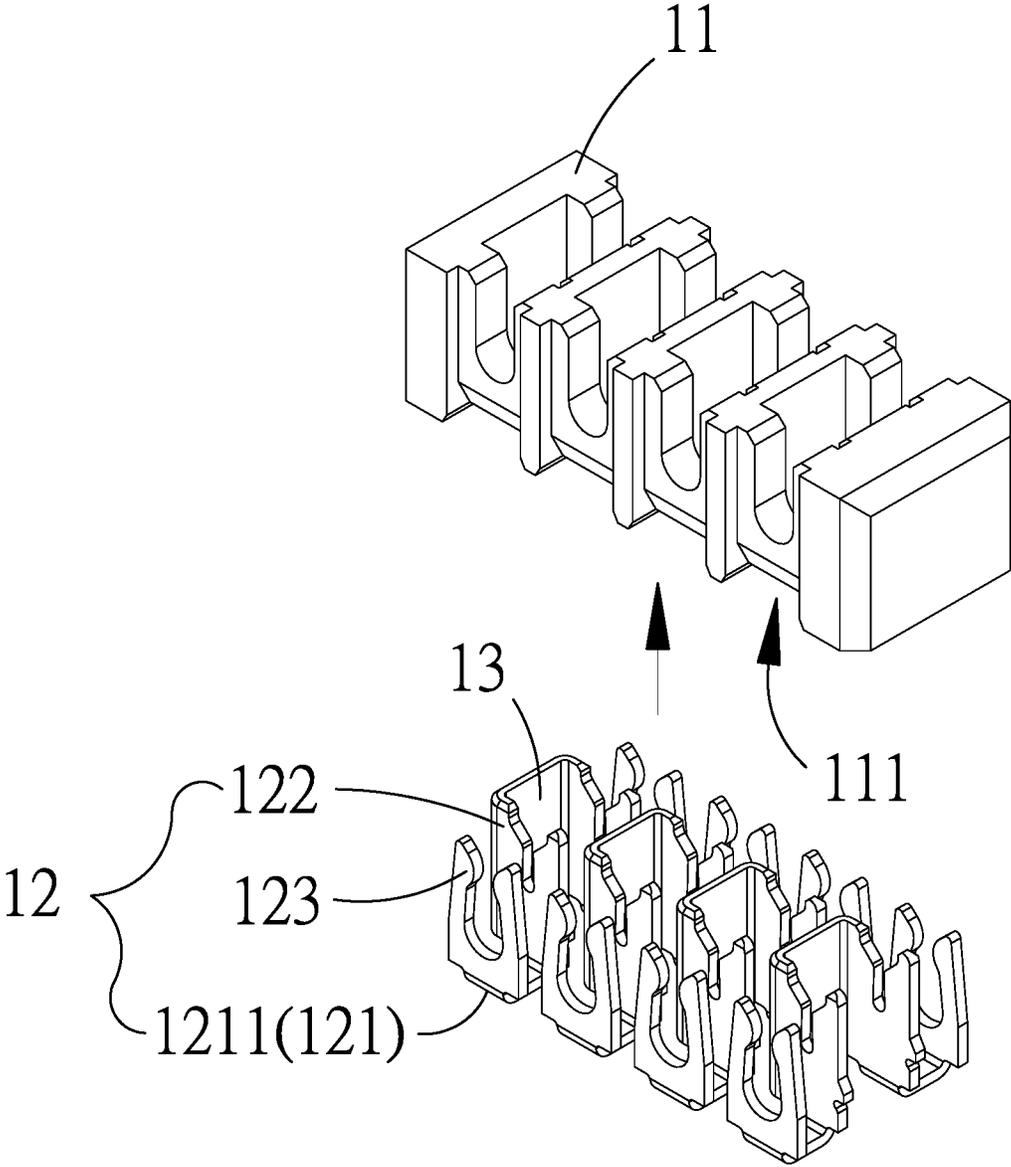


Figure 9

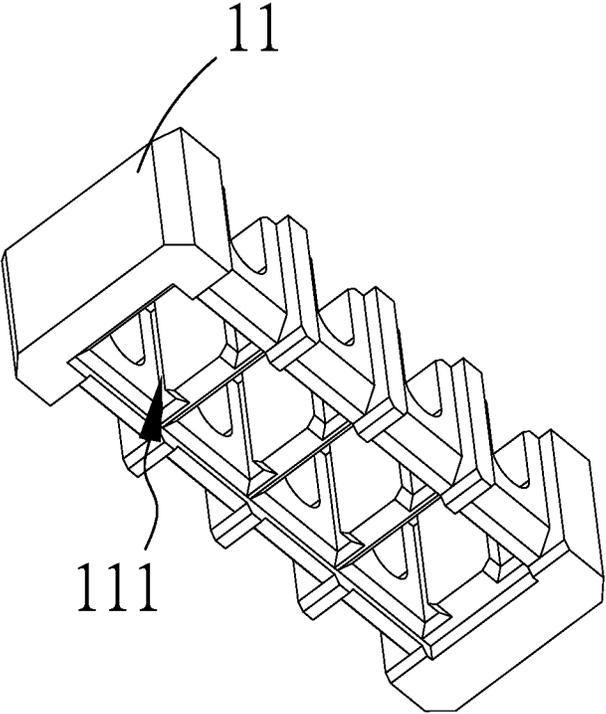


Figure 10

12

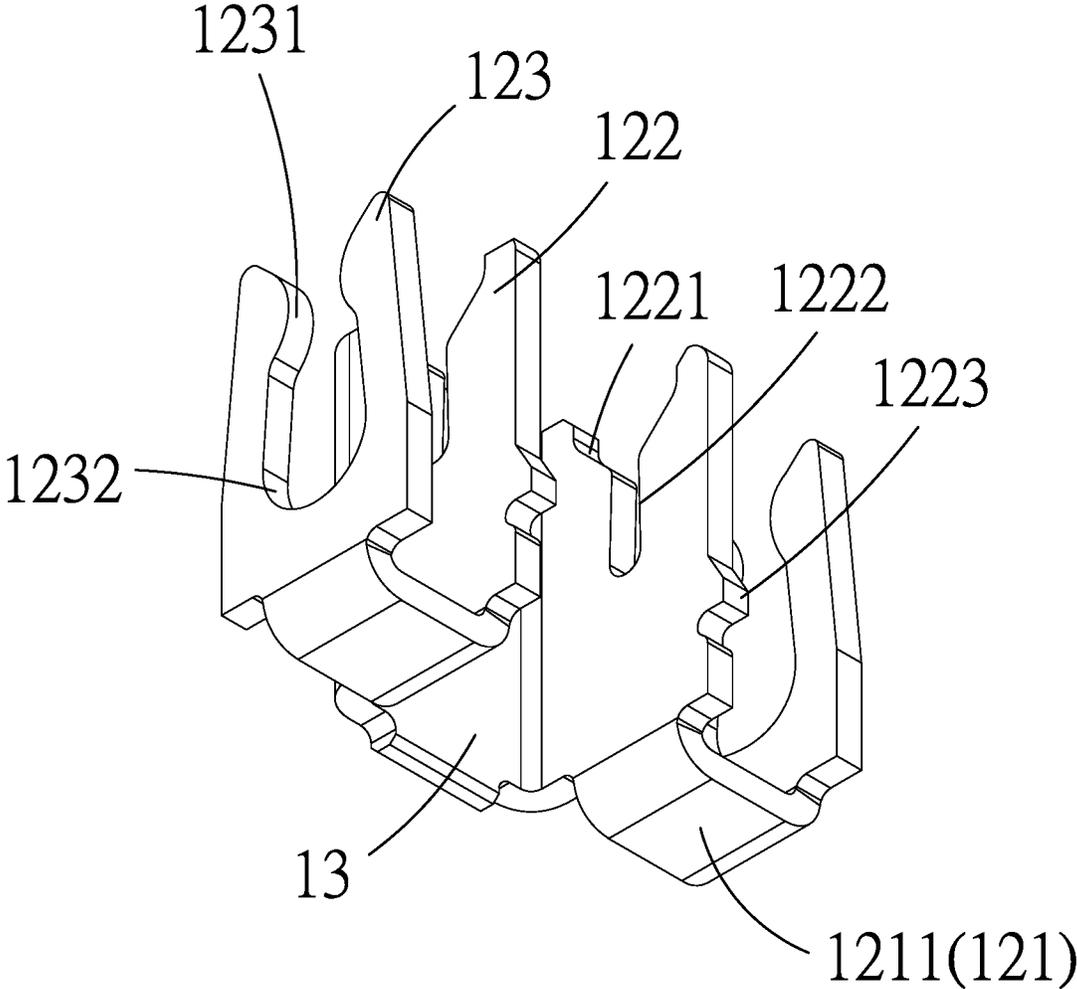


Figure 11

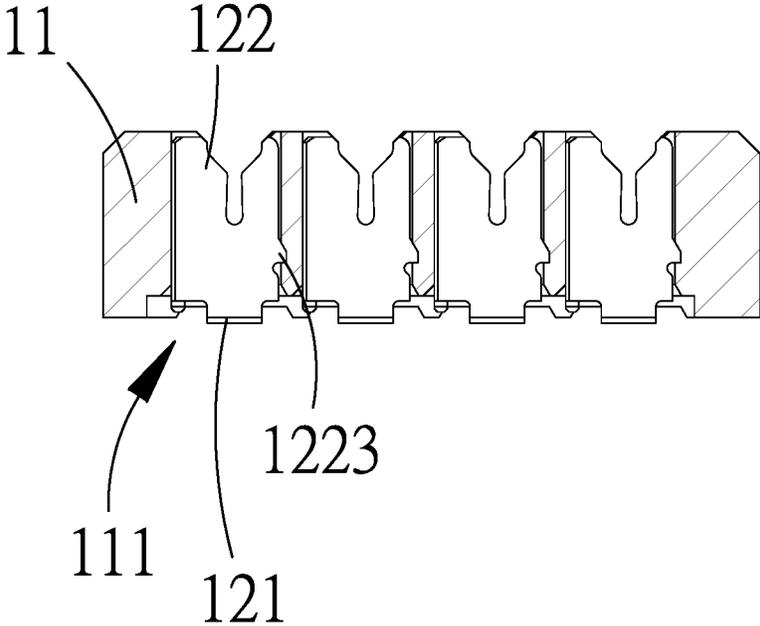


Figure 12

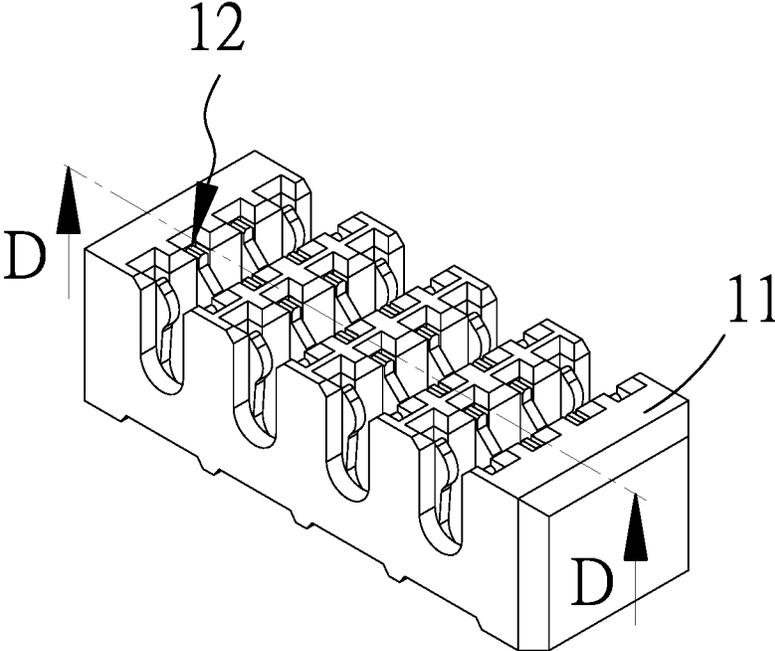


Figure 13

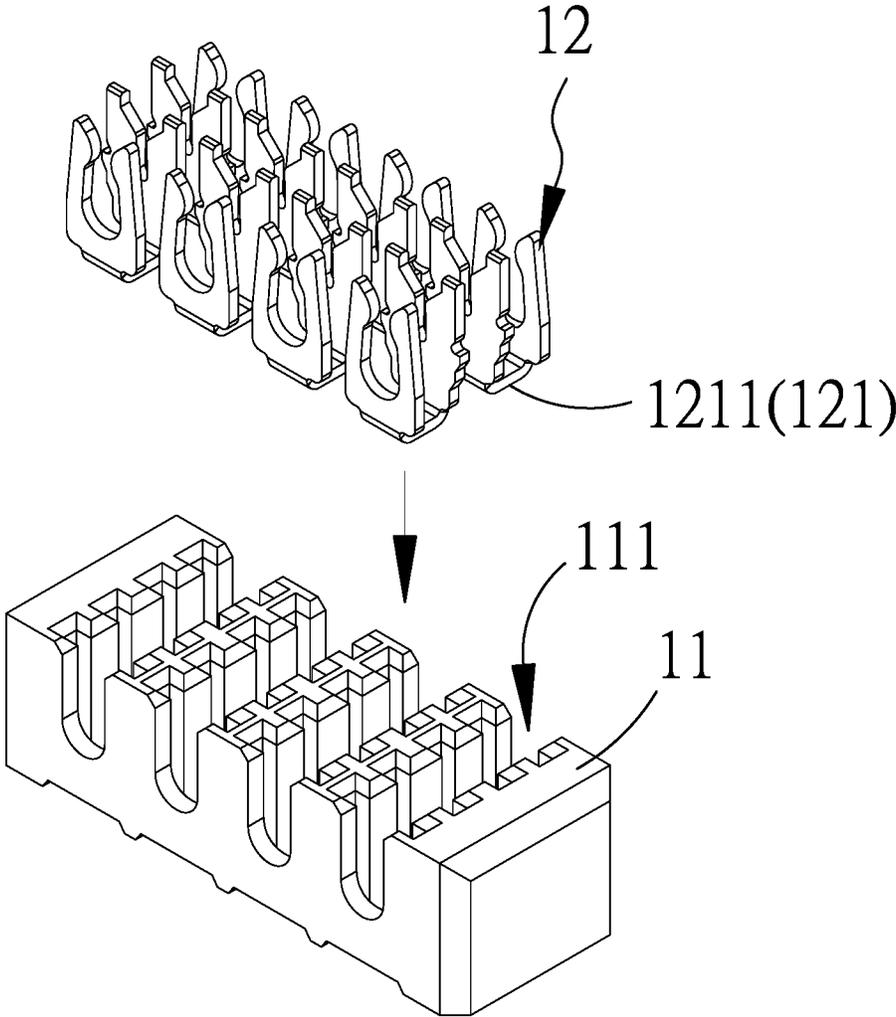


Figure 14

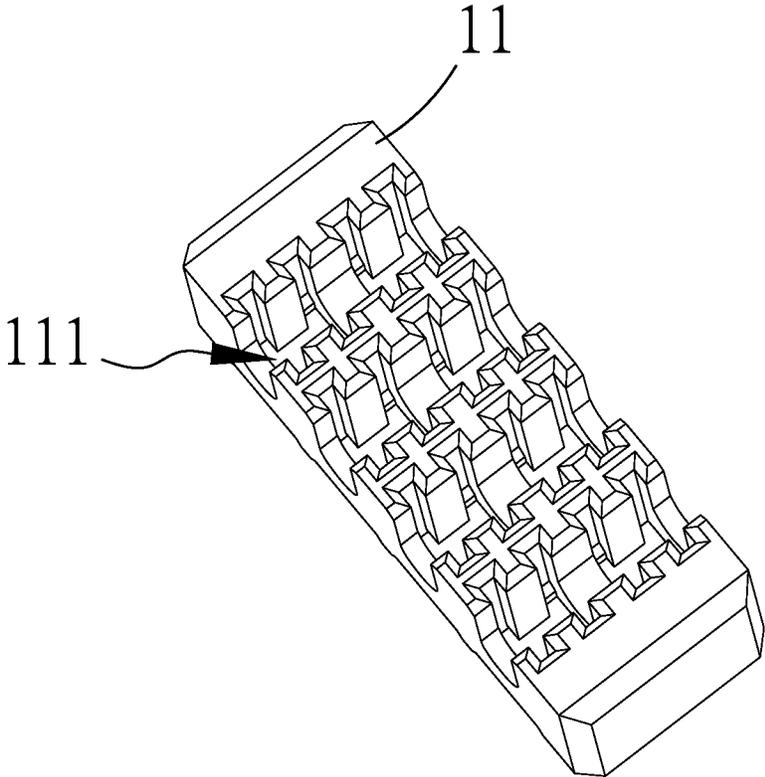


Figure 15

12

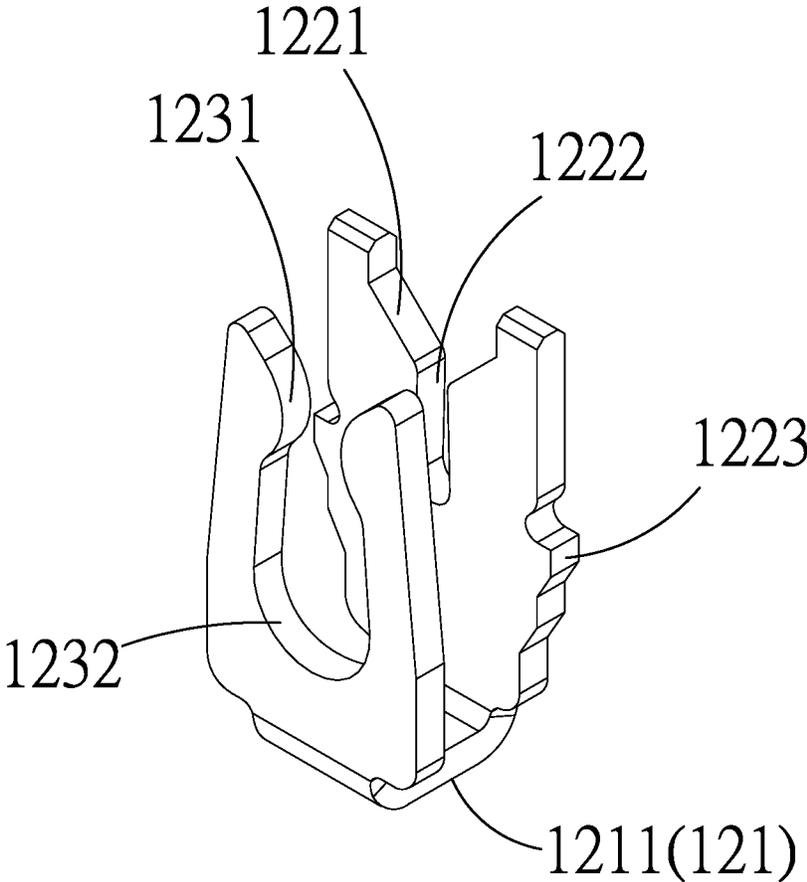


Figure 16

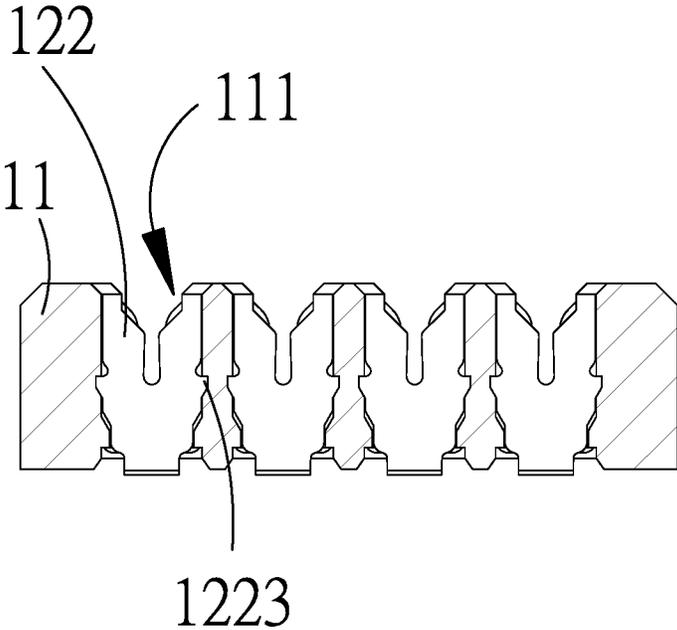


Figure 17

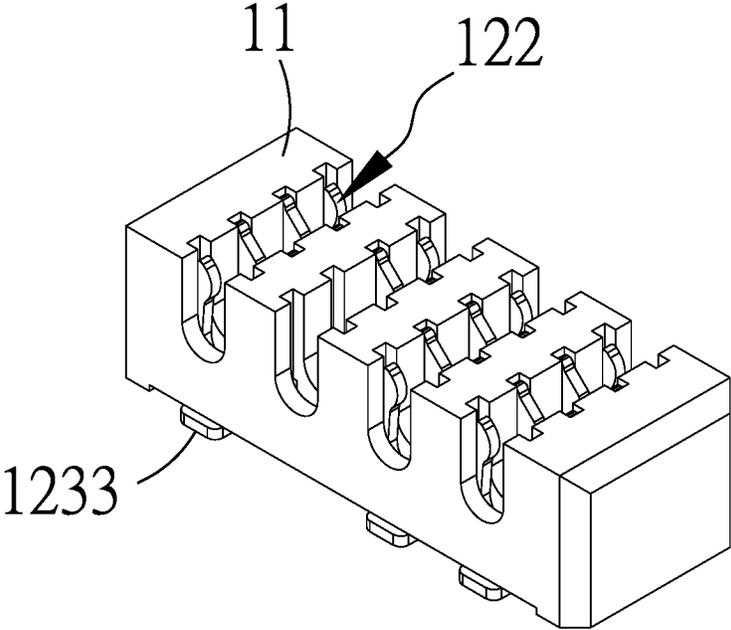


Figure 18

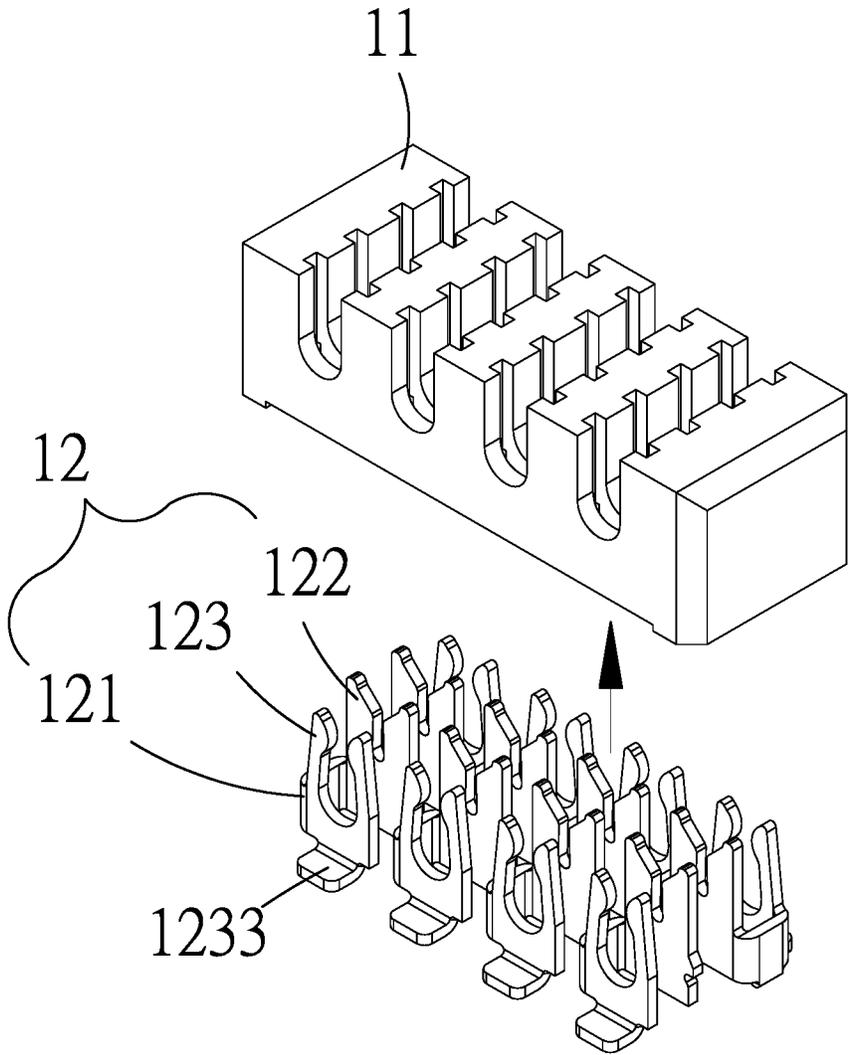


Figure 19

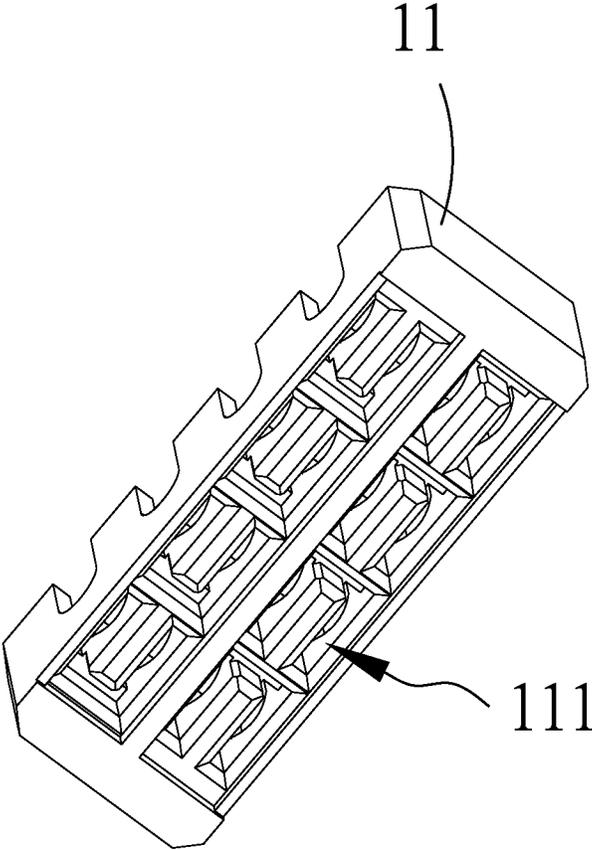


Figure 20

12

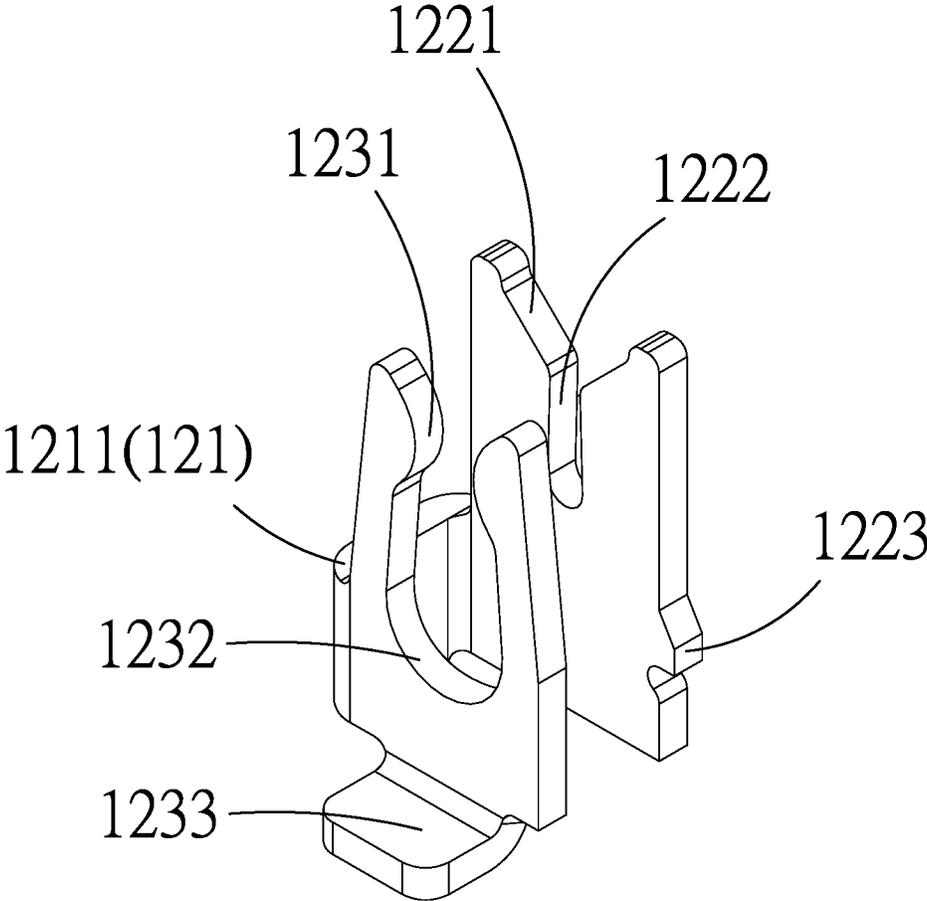


Figure 21

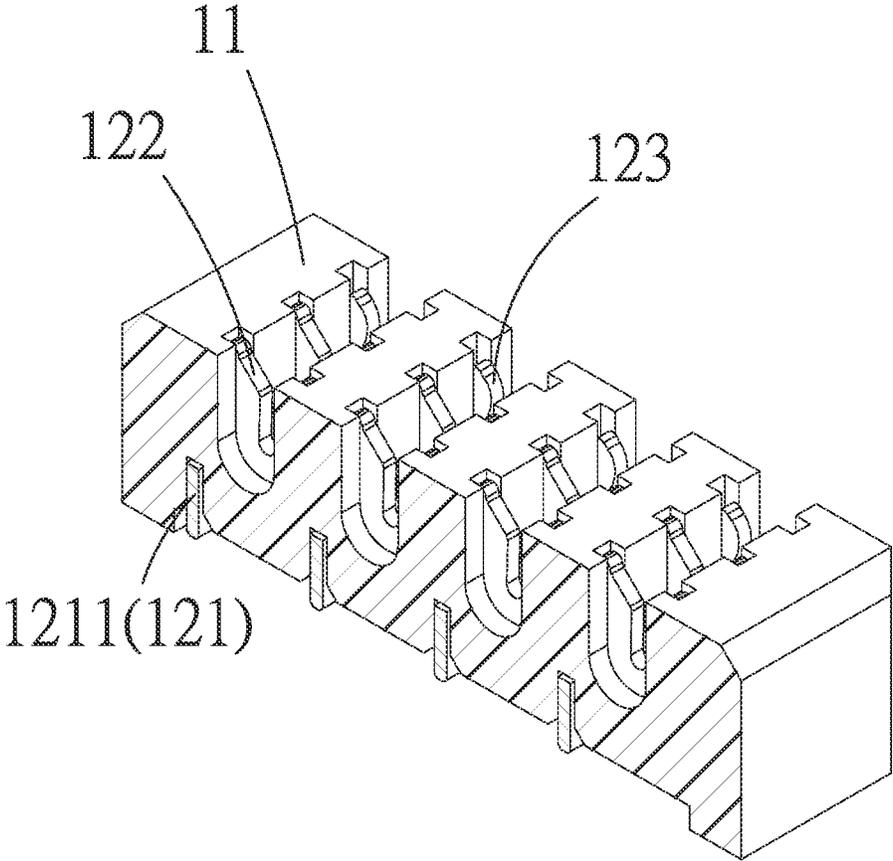


Figure 22

CABLE CONNECTOR**CROSS-REFERENCE TO RELATED APPLICATIONS**

This application claims the priority of Taiwan Application No. 107139138 filed on Nov. 5, 2018, in the State Intellectual Property Office of the R.O.C., the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION**Field of the Invention**

The present invention relates to connectors, and more particularly, to a cable connector for forming electrical connection with cables.

Descriptions of the Related Art

Technological innovations of wearable devices integrate electronic elements and information transmission techniques with wearable smart clothes, which have been massively developed. To be user friendly, the electronic elements preferably use thin cables in order to be well accommodated in the wearable smart clothes. In such a case, how to form proper electrical connection for the cables of the electronic elements must be considered. If there is no effective electrical connection for the cables of the electronic elements, the electronic elements cannot work as desired and the smart clothes would fail in function.

Therefore, how to provide a connector that can effectively form electrical connection for thin cables is an important task to be solved in the art.

SUMMARY OF THE INVENTION

In view of the above drawback in the prior art, the present invention is to provide a cable connector for forming electrical connection with a cable, the cable including a core and an outer insulating sheath covering the core, the cable connector including: an insulation base having an embedding opening; and at least one conductive terminal embedded in the insulation base through the embedding opening, the at least one conductive terminal including a terminal body, a piercing wall and a positioning wall, the piercing wall including a piercing guiding portion and a piercing blade portion, the positioning wall including a positioning guiding portion and a positioning hole, wherein the positioning wall and the piercing wall are extended from a side of the terminal body to make the piercing guiding portion and the positioning guiding portion open towards a predetermined direction, so as to allow the cable to move in the predetermined direction and reach the piercing guiding portion and the positioning guiding portion where the cable is guided by the piercing guiding portion and the positioning guiding portion to enter the piercing blade portion and the positioning hole, wherein the outer insulating sheath is pierced by the piercing blade portion and the core is electrically connected to the piercing blade portion, and the cable is accommodated in and positioned by the positioning hole.

Preferably, the cable connector said above, wherein the embedding opening is provided on a top or bottom side of the insulation base, allowing the at least one conductive terminal to be embedded in the insulation base from the top or bottom side of the insulation base through the embedding

opening, and the terminal body is coupled to shorter or longer sides of both the positioning wall and piercing wall.

Preferably, the cable connector said above, wherein the terminal body is positioned on a side of the insulation base away from the embedding opening.

Preferably, the cable connector said above, further including at least one coupling wall, and wherein the at least one conductive terminal includes two conductive terminals forming a single unit by the coupling wall that is coupled to the piercing walls of the two conductive terminals.

Preferably, the cable connector said above, further including a plurality of coupling walls, and wherein the at least one conductive terminal includes a plurality of conductive terminals, and each of the coupling walls is coupled to two of the plurality of conductive terminals, so as to form a plurality of single units from the plurality of coupling walls and their corresponding coupled conductive terminals, wherein the plurality of single units are aligned in rows and embedded in the insulation base at intervals.

Preferably, the cable connector said above, wherein the coupling wall is coupled to longer sides of the piercing walls.

Preferably, the cable connector said above, wherein a bottom side of the terminal body is formed a bonding portion that is exposed from the bottom side of the insulation base, and is used for bonding a carrier so as to achieve electrical connection with the carrier.

Preferably, the cable connector said above, wherein the positioning wall is extended in a direction away from the piercing wall to form a bonding portion exposed from the insulation base, wherein the bonding portion is for being bonded to a carrier to form electrical connection between the cable connector and the carrier.

Preferably, the cable connector said above, wherein the piercing wall and the positioning wall respectively have a U-shape cross section.

Preferably, the cable connector said above, wherein the at least one conductive terminal includes a plurality of conductive terminals that are aligned in rows and embedded in the insulation base at intervals.

Preferably, the cable connector said above, wherein the positioning wall and the piercing wall are substantially parallel to each other, and the piercing blade portion faces directly the positioning hole.

Preferably, the cable connector said above, wherein the piercing wall has a left-right symmetrical structure, allowing the piercing guiding portion to guide the cable to enter the piercing blade portion in a middle position, and making both left and right sides of the piercing blade portion electrically connected to the core.

Preferably, the cable connector said above, wherein when the cable is entering the positioning hole, the cable touches the positioning guiding portion, making the positioning wall have a first shape to guide the cable to enter the positioning hole, and after the cable enters the positioning hole, the cable leaves the positioning guiding portion, making the positioning wall have a second shape to position the cable within the positioning hole.

Preferably, the cable connector said above, wherein the piercing wall further includes an engaging portion that is used to engage the insulation base after the conductive terminal is embedded in the insulation base and thus to keep the conductive terminal in position.

In comparison to prior arts, a primary object of the present invention is to provide a cable connector. The cable connector includes a conductive terminal having a piercing wall. The piercing wall can pierce an outer insulating sheath

of a thin cable to be electrically connected to an inner core of the cable. The conductive terminal further includes a positioning wall for positioning the thin cable to reduce bending or dislocation of the thin cable caused by a force and thus minimize pulling of the core, thereby ensuring electrical connection between the piercing wall and the core of the thin cable. Thus, the cable connector of the present invention is well applicable to forming electrical connection with thin cables.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other aspects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a schematic diagram showing a usage status of a cable connector according to the present invention.

FIG. 2 is a schematic diagram showing the cable connector of FIG. 1 without an insulation base.

FIG. 3 is a top view of the cable connector shown in FIG. 1.

FIG. 4-1 is a cross-sectional diagram of the cable connector shown in FIG. 3 cut along line AA, wherein cables have not entered piercing blade portions.

FIG. 4-2 is a cross-sectional diagram of the cable connector shown in FIG. 3 cut along line AA, wherein the cables have entered the piercing blade portions.

FIG. 5-1 is a cross-sectional diagram of the cable connector shown in FIG. 3 cut along line BB, wherein positioning walls have a first shape.

FIG. 5-2 is a cross-sectional diagram of the cable connector shown in FIG. 3 cut along line BB, wherein the positioning walls have a second shape.

FIG. 6 is a schematic diagram showing a cable connector according to a first embodiment of the present invention.

FIG. 7 is a top view of the cable connector shown in FIG. 6.

FIG. 8 is a bottom view of the cable connector shown in FIG. 6.

FIG. 9 is a breakdown diagram of the cable connector shown in FIG. 6.

FIG. 10 is a schematic diagram of an insulation base of the cable connector shown in FIG. 6.

FIG. 11 is a schematic diagram of conductive terminals of the cable connector shown in FIG. 6.

FIG. 12 is a cross-sectional diagram of the cable connector shown in FIG. 6 cut along line CC.

FIG. 13 is a schematic diagram showing a cable connector according to a second embodiment of the present invention.

FIG. 14 is a breakdown diagram of the cable connector shown in FIG. 13.

FIG. 15 is a schematic diagram of an insulation base of the cable connector shown in FIG. 13.

FIG. 16 is a schematic diagram of a conductive terminal of the cable connector shown in FIG. 13.

FIG. 17 is a cross-sectional diagram of the cable connector shown in FIG. 13 cut along line DD.

FIG. 18 is a schematic diagram showing a cable connector according to a third embodiment of the present invention.

FIG. 19 is a breakdown diagram of the cable connector shown in FIG. 18.

FIG. 20 is a schematic diagram of an insulation base of the cable connector shown in FIG. 18.

FIG. 21 is a schematic diagram of a conductive terminal of the cable connector shown in FIG. 18.

FIG. 22 is a cross-sectional diagram of the cable connector shown in FIG. 18 cut along line EE.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Embodiments of the present invention will now be described in detail with reference to the accompanying drawings. The invention may, however, be embodied in many different forms and should not be construed as being limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. In the drawings, the shapes and dimensions of elements may be exaggerated for clarity, and the same reference numerals will be used throughout to designate the same or like components.

The present invention provides a cable connector, which is described hereinafter with reference to FIGS. 1 to 22.

As shown in FIGS. 1 to 4, FIGS. 4-1 and 4-2, and FIGS. 5-1 and 5-2, the cable connector 1 according to the present invention is used for electrically connecting a core 21 of a cable 2. The cable 2 further includes an outer insulating sheath 22 (for example, rubber sheath) covering the core 21. The cable connector 1 includes an insulation base 11 and at least one conductive terminal 12. As shown in FIG. 2, the at least one conductive terminal 12 may include a plurality of conductive terminals 12. The conductive terminal 12 is embedded in the insulation base 11 and positioned by the insulation base 11. The conductive terminal 12 includes a terminal body 121, a piercing wall 122 and a positioning wall 123. The piercing wall 122 includes a piercing guiding portion 1221 and a piercing blade portion 1222. The positioning wall 123 includes a positioning guiding portion 1231 and a positioning hole 1232. As shown in FIG. 2, the positioning wall 123 and the piercing wall 122 are extended upwardly from a side of the terminal body 121, making the piercing guiding portion 1221 and the positioning guiding portion 1231 open towards a predetermined direction, such that the cable 2 can move in the predetermined direction to reach and touch the piercing guiding portion 1221 and the positioning guiding portion 1231 respectively which then guide the cable 2 to enter the piercing blade portion 1222 and the positioning hole 1232.

Preferably, the piercing wall 122 and the positioning wall 123 respectively have a U-shape cross section and are substantially parallel to each other, and the piercing blade portion 1222 faces directly the positioning hole 1232.

When the cable 2 is entering the piercing blade portion 1222, as shown in FIG. 4-1, it touches the piercing guiding portion 1221 and is thus guided to enter the piercing blade portion 1222. As shown in FIG. 4-2, when the cable 2 enters the piercing blade portion 1222, the piercing blade portion 1222 pierces the outer insulating sheath 22 of the cable 2 and is electrically connected to the core 21 of the cable 2.

When the cable 2 is entering the positioning hole 1232, as shown in FIG. 5-1, it touches the positioning guiding portion 1231 and makes the positioning wall 123 become a first shape to allow the cable 2 to move along the positioning guiding portion 1231 and enter the positioning hole 1232. After the cable 2 enters the positioning hole 1232, as shown in FIG. 5-2, it leaves the positioning guiding portion 1231 and makes the positioning wall 123 become a second shape that restricts further movement of the cable 2, such that the cable 2 cannot move along the positioning guiding portion 1231 to leave the positioning hole 1232, but is kept within

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the positioning hole **1232**, thereby having the cable **2** accommodated in and positioned by the positioning hole **1232**.

The present invention is further described according to the following embodiments, wherein identical or similar parts may be assigned with same reference numerals, and identical or similar technical features may not be described repeatedly.

First Embodiment

As shown in FIGS. **6** to **12**, there is further formed an embedding opening **111** on a bottom side of the insulation base **11**, allowing the conductive terminal **12** to be embedded into the insulation base **11** from the bottom side through the embedding opening **111**. Thus, as shown in FIG. **9**, the terminal body **121** is located on the same side as the embedding opening **111**. Preferably, the terminal body **121** is connected to both shorter ends of the positioning wall **123** and piercing wall **122**. The piercing wall **122** has a left-right symmetrical structure, which makes the piercing guiding portion **1221** of the piercing wall **122** able to guide the cable **2** to enter the piercing blade portion **1222** in a middle position, so as to allow the piercing blade portion **1222** to have both its right and left sides electrically connected to the core **21** of the cable **2**, thereby enhancing electrical characteristics of the cable connector **1**.

Moreover, the piercing wall **122** of the conductive terminal **12** further includes an engaging portion **1223** that is used to engage the insulation base **11** after the conductive terminal **12** is embedded in the insulation base **11** and thus to keep the conductive terminal **12** in position in order not to be separated from the insulation base **11**, thereby ensuring reliability of the cable connector **1**.

There is further formed a bonding portion **1211** on a bottom side of the terminal body **121**. As shown in FIG. **6**, the bonding portion **1211** is exposed from the bottom side of the insulation base **11**, and is used for bonding a carrier so as to achieve electrical connection between the cable connector of the present invention and the carrier. Referring to FIG. **11** showing two conductive terminals **12**, the cable connector **1** further includes a coupling wall **13** for coupling longer sides of the piercing walls **122** of the two conductive terminals **12** together to make the two conductive terminals **12** become a single unit. This single unit can provide positioning and electrical connection for two positions on left and right sides of the cable **2** simultaneously, and the cable connector **1** is thus more flexible in use to meet different electrical characteristic requirements.

As shown in FIG. **9**, the cable connector **1** further includes a plurality of coupling walls **13**, each of which is used for coupling corresponding two conductive terminals **12** together, thereby forming a plurality of single units. Also as shown in FIG. **6**, the plurality of single units are aligned in rows and embedded in the insulation base **11** at intervals.

Second Embodiment

As shown in FIGS. **13** to **17**, the embedding opening **111** is alternatively formed on a top side of the insulation base **11**, allowing the conductive terminal **12** to be embedded into the insulation base **11** from the top side through the embedding opening **111**. As shown in FIG. **14**, the terminal body **121** can thus be positioned on a side of the insulation base **11** away from the embedding opening **111**.

In this embodiment, there is no coupling wall **13** provided for the conductive terminal **12**, which means that the con-

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ductive terminal **12** consists of the terminal body **121**, the piercing wall **122** and the positioning wall **123**. This also makes the cable connector more flexible in configuration to meet different electrical characteristic requirements.

Third Embodiment

As shown in FIGS. **18** to **22**, the embedding opening **111** is alternatively formed on the bottom side of the insulation base **11**, allowing the conductive terminal **12** to be embedded into the insulation base **11** from the bottom side through the embedding opening **111**. As shown in FIG. **21**, the terminal body **121** of the conductive terminal **12** couples both longer sides of the positioning wall **123** and piercing wall **122** together.

In this embodiment, as shown in FIG. **18**, the positioning wall **123** is extended in a direction away from the piercing wall **122** to form a bonding portion **1233**. The bonding portion **1233** is exposed from the bottom side of the insulation base **11**, and is used for bonding a carrier so as to achieve electrical connection between the cable connector and the carrier.

In summary, a primary object of the present invention is to provide a cable connector. The cable connector includes a conductive terminal having a piercing wall. The piercing wall can pierce an outer insulating sheath of a thin cable to be electrically connected to an inner core of the cable. The conductive terminal further includes a positioning wall for positioning the thin cable to reduce bending or dislocation of the thin cable caused by a force and thus minimize pulling of the core, thereby ensuring electrical connection between the piercing wall and the core of the thin cable. Thus, the cable connector of the present invention is well applicable to forming electrical connection with thin cables.

The examples above are only illustrative to explain principles and effects of the invention, but not to limit the invention. It will be apparent to those skilled in the art that modifications and variations can be made without departing from the spirit and scope of the invention. Therefore, the protection range of the rights of the invention should be as defined by the appended claims.

What is claimed is:

1. A cable connector for forming electrical connection with a cable, the cable including a core and an outer insulating sheath covering the core, the cable connector including:

an insulation base having an embedding opening, an insulation guiding portion, and an insulation supporting portion, wherein the insulation guiding portion opens toward a predetermined direction to guide the cable to enter the insulation base in the predetermined direction; and

at least one conductive terminal embedded in the insulation base to contact the insulation supporting portion through the embedding opening, the at least one conductive terminal including a terminal body, a piercing wall and a positioning wall, the piercing wall including a piercing guiding portion and a piercing blade portion, the positioning wall including a positioning guiding portion and a positioning hole, wherein the positioning wall and the piercing wall are extended from a side of the terminal body to make the piercing guiding portion and the positioning guiding portion open towards the predetermined direction, so as to allow the cable entering the insulation base to move in the predetermined direction and reach the piercing guiding portion and the positioning guiding portion where the cable is guided

by the piercing guiding portion and the positioning guiding portion to enter the piercing blade portion and the positioning hole, wherein the outer insulating sheath is pierced by the piercing blade portion and the core is electrically connected to the piercing blade portion, and the cable is accommodated in and positioned by the positioning hole, wherein the insulation supporting portion provides support to the at least one conductive terminal to minimize a deformation of the at least one conductive terminal during a process that the outer insulating sheath is pierced by the piercing blade portion and the cable is positioned by the positioning hole.

2. The cable connector according to claim 1, wherein the embedding opening is provided on a top or bottom side of the insulation base, allowing the at least one conductive terminal to be embedded in the insulation base from the top or bottom side of the insulation base through the embedding opening, and the terminal body is coupled to shorter or longer sides of both the positioning wall and piercing wall.

3. The cable connector according to claim 1, wherein the terminal body is positioned on a side of the insulation base away from the embedding opening.

4. The cable connector according to claim 3, further including a plurality of coupling walls, and wherein the at least one conductive terminal includes a plurality of conductive terminals, and each of the coupling walls is coupled to two of the plurality of conductive terminals, so as to form a plurality of single units from the plurality of coupling walls and their corresponding coupled conductive terminals, wherein the plurality of single units are aligned in rows and embedded in the insulation base at intervals.

5. The cable connector according to claim 3, wherein the coupling wall is coupled to longer sides of the piercing walls.

6. The cable connector according to claim 1, further including at least one coupling wall, and wherein the at least one conductive terminal includes two conductive terminals forming a single unit by the coupling wall that is coupled to the piercing walls of the two conductive terminals.

7. The cable connector according to claim 1, wherein a bottom side of the terminal body is formed a bonding portion

that is exposed from the bottom side of the insulation base, and is used for bonding a carrier so as to achieve electrical connection with the carrier.

8. The cable connector according to claim 1, wherein the positioning wall is extended in a direction away from the piercing wall to form a bonding portion exposed from the insulation base, wherein the bonding portion is for being bonded to a carrier to form electrical connection between the cable connector and the carrier.

9. The cable connector according to claim 1, wherein the piercing wall and the positioning wall respectively have a U-shape cross section.

10. The cable connector according to claim 1, wherein the at least one conductive terminal includes a plurality of conductive terminals that are aligned in rows and embedded in the insulation base at intervals.

11. The cable connector according to claim 1, wherein the positioning wall and the piercing wall are substantially parallel to each other, and the piercing blade portion faces directly the positioning hole.

12. The cable connector according to claim 1, wherein the piercing wall has a left-right symmetrical structure, allowing the piercing guiding portion to guide the cable to enter the piercing blade portion in a middle position, and making both left and right sides of the piercing blade portion electrically connected to the core.

13. The cable connector according to claim 1, wherein when the cable is entering the positioning hole, the cable touches the positioning guiding portion, making the positioning wall have a first shape to guide the cable to enter the positioning hole, and after the cable enters the positioning hole, the cable leaves the positioning guiding portion, making the positioning wall have a second shape to position the cable within the positioning hole.

14. The cable connector according to claim 1, wherein the piercing wall further includes an engaging portion that is used to engage the insulation base after the conductive terminal is embedded in the insulation base and thus to keep the conductive terminal in position.

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